

SIGMA XI QUARTERLY

Vol. XV

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No. 4



CHAPTER NUMBER

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SIGMA XI QUARTERLY

EDITORIAL COMMITTEE

FLOYD KARKER RICHTMYER
EDWIN EMERY SLOSSON

HENRY BALDWIN WARD
EDWARD ELLERY

VOL. XV

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EDITORIAL COMMENT

THE 28th CONVENTION

The question of immediate importance for each chapter to consider is, shall it be represented at the convention? We quote from an editorial comment in the March (1927) issue of the *QUARTERLY*:

"There is one feature of the Society's convention to which the national officers feel that chapters should give special consideration, namely, a more complete chapter representation. At Kansas City in 1925, 23 of the 42 chapters were represented by delegates. At Philadelphia, delegates were present from 24 of the 45 chapters. In other words, at the last two national conventions, important business of a great organization was transacted by a few over one-half of the total number of constituent branches.

"Of the chapters from which prior to the convention the secretary had received notice of the official appointment of delegates there were five whose representatives did not appear at the convention, or if they were present failed to present credentials to the Committee on Credentials and to register a vote on those matters on which a viva voce vote was taken.

"In this connection, the attention of chapters is called to the following excerpts from the National Constitution and By-Laws:

"The Constitution. Article VIII, Section 2. Delegates. (a) Each chapter in good and regular standing shall be entitled to a representation of not more than three delegates at each convention. (b). . . . in case any chapter shall be unable to send its own members, it may appoint members of any other chapter as its representatives.

"The By-Laws. Article I, Section 4. The expenses of delegates shall be provided by the chapter sending them.

"Sigma Xi is constantly growing in size and influence. The business before its convention increases in importance each year. Chapters are urged to keep these facts in mind. Not only should a delegate or delegates be appointed, but arrangements should be made sufficiently in advance so that the representatives will actually take part in the transaction of the business of the Society."

We hope for a much larger representation at the Nashville Convention than in 1925 and 1926.

* * * * *

THE CONVENTION PROGRAM

Place: Nashville, Tenn.

Day: Tuesday, December 27, 1927

Program:

2:00 P.M. Business session

6:00 P.M. Annual dinner

8:30 P.M. Sixth Annual Sigma Xi Lecture under the joint auspices of the Association and the Society

Speaker: President Little, University of Michigan

Topic: "Opportunities for Research in Mammalian Genetics"

* * * * *

THE CHAPTER REPORTS

Not every chapter has submitted a report of activities. We wish the situation might be otherwise. All chapters like to know what the chapters are doing, the position they take in their respective institutions, the influence they are exerting in furthering the aim of the society, namely, the promotion of research. Such reports are suggestive and helpful. No one can read them without getting the impression of variety in the work of the membership and of the friendliness of investigators in any field for workers in all other fields. Will chapter secretaries note now that either in the September or December number of the *QUARTERLY* each year excerpts from such reports will be printed, and send to the National Secretary next June a statement of the chapter activities for 1927-28?

* * * * *

The letter we print from Sir Ernest Rutherford is in reality a report from him as a Sigma Xi Research Fellow of 1926-27. There is no need to add that the entire scientific world will be benefited by what Sigma Xi has been able to do by making a contribution to the work of this brilliant investigator. We print the portion of the Guthrie Lecture to which Sir Ernest refers.

* * * * *

The Alumni Committee announces the formation of The Midwest Association of Sigma Xi, with headquarters in Chicago. It is contemplated to include on its mailing list all the institutional chapters within overnight traveling distance of Chicago and to keep such chapters informed regarding the meetings of the Association. The Directors of the Association are as follows:

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The Alumni Committee and the officers of the society deeply appreciate the enthusiastic services of Mr. Donald H. Sweet, who has brought about the organization of this Alumni Association.

* * * * *

The letters from the alumni make most interesting reading. We print excerpts from several. While there are some of our alumni members who are not enthusiastic about the organization and its efforts to promote research, the great majority from whom we have heard respond with interest and satisfaction. The secretary will make a full report regarding Sigma Xi alumni to the convention, and the report will be printed in the March issue of the *QUARTERLY*.

REPORT FROM SIR ERNEST RUTHERFORD

Cavendish Laboratory, Cambridge.

August 16, 1927.

Dear Dean Ellery:

I am myself very sorry not to be able to visit your country and see you all again under such pleasant conditions but I am very much bound to the wheel by my work and official duties.

With regard to the Sigma Xi contribution, I have not yet spent it. We have been going into the question of the design of two new pieces of apparatus which will be useful to develop my work but have not yet reached a final decision. Your fund will be useful to help defray the expense of these instruments. Under these conditions I will delay a report, unless you yourself would be prepared to put in a phrase concerning what I have said.

Actually this year I have been very busily occupied in developing a new theory of the constitution of the radioactive nucleus, and I think I can connect together the energy of emission of α rays and the γ rays with my theory. I have much pleasure in forwarding you a copy of the Guthrie Lecture in which, on the last page, you will see my general ideas on the question put forward in a general way.* Since then I have gone into it much further and am sending a paper to the *Philosophical Magazine* on the application of the theory to explain radioactive phenomena. I hope this will prove a step in advance for so far our theories of the nucleus are in an embryonic state.

With best wishes,

Yours sincerely,

E. RUTHERFORD.

* See page 82.

RADIOACTIVE NUCLEI*

SIR ERNEST RUTHERFORD

We shall first discuss a marked discrepancy between the dimensions of the nucleus of uranium when estimated from scattering and radioactive data. Rutherford and Chadwick found that the scattering of a film of uranium appeared to be normal—i. e., to correspond to a coulomb law of force up to a distance 3.2×10^{-12} cm. It should be pointed out that while the variation of scattering with velocity of the α particle appeared to be normal within the experimental error, yet, owing to the difficulty of estimating the weight of the uranium film with accuracy, the actual number of scattered α particles could not be compared with calculation with any certainty.

The α particle expelled from uranium I has the smallest initial energy known, corresponding to 6.77×10^{-6} erg, or 4.25×10^4 electron-volts. Since the α particle must gain a part at least of its energy in escaping in the repulsive field, it is easy to calculate on a coulomb law of force that, even if the α particle has no initial velocity when it leaves the nuclear structure, it cannot originate from a point less than 7×10^{-12} cm. from the center of the nucleus of charge 90.

While it is impossible that positively charged particles like the proton or α particle can remain in equilibrium under a coulomb law of repulsive force, the case is quite different if the particles are electrically neutral. A neutral particle can be held in equilibrium by the attractive forces either due to the polarization of the neutral particle by the electric field from the charged central nucleus, or due to magnetic forces arising from the nucleus or to a combination of both types of forces. Preliminary calculations on reasonable assumptions show that the attractive forces due to these causes are of the right order of magnitude to hold the particles in equilibrium when in circulation round the central nucleus.

We thus arrive at a general conception of nuclear structure in which the central charged nucleus is surrounded by a number of uncharged particles. In a paper before the Franklin Institute in 1924 I put forward a suggestion that the central nucleus was a closely ordered arrangement of α particles and electrons in a semicrystalline form.

* Part of the 12th Guthrie Lecture, reprinted from the "Proceedings" of the Physical Society issued June 15, 1927.

tion, and showed that certain simple arrangements were in fair accord with the charge and mass of some of the atoms. Whatever view we may take on this question, I am inclined to believe that the central nucleus of the heavier elements is a very compact structure, occupying a very small volume of radius of the order 1×10^{-12} cm. The neutral satellites circulating round this nucleus may extend to a distance large compared with the linear dimensions of the main nucleus.

If we take the uncharged α particle as a type of a neutral satellite, it must consist of the helium nucleus which has gained two electrons. These electrons cannot occupy the same positions as in the ordinary helium atom in the free state, for in such a case they would at once be torn off by the intense electric fields due to the nucleus. They are probably much more closely bound to the nucleus, circulating in orbits which are only rendered possible by the distortion of the nuclear structure of the α particle by the intense electrical or magnetic fields from the central nucleus. Such a view seems not unreasonable, for undoubtedly all composite nuclei must suffer serious distortion under the enormous fields which are present in nuclear structures. In fields below a certain critical value, these electron orbits cannot exist, and consequently a neutral α particle in escaping from the nuclear structure would be robbed of its two electrons when the critical field is reached.

We can thus form the following picture of the emission of an α particle from a radioactive element. Occasionally one of the neutral α particles which are probably circulating in quantized orbits is for some cause displaced from its position of equilibrium and has sufficient energy of motion to escape from the attractive field of the central nucleus. When the field falls below the critical value, the neutralizing electrons are removed and fall back towards the nucleus. The α particle, which has now two positive charges, gains additional energy in passing through the repulsive electric field of the nucleus and emerges as a high-speed α particle. It is of interest to note that Fräulein Meitner from consideration of the successive modes of transformation of radioactive atoms concluded that some of the α particles in the nucleus must exist in the neutral state. On the present views all the α particles which escape from radioactive nuclei have their origin as neutral satellites.

We must now follow for a moment the fate of the electrons which are liberated from the neutral α particle. From the known change

of charge in a radioactive transformation, it is clear that they must fall back towards the main nucleus, probably describing orbits under the complicated system of forces which must exist close to the nucleus in a region where the forces due to distortion may be all-important. Occasionally one of these electrons is given sufficient energy to escape entirely from the nucleus thus giving rise to a β ray transformation.

In our picture of the nucleus, we thus have a concentrated inner nucleus carrying a positive charge surrounded at a short distance by a number of electrons, and then at a distance a number of neutral satellites circulating round the system. I hope in a later paper to give a fuller discussion of this type of nuclear structure which offers certain possibilities of interpretation of the wealth of radioactive data at our disposal.

This picture of a nucleus need not be confined only to the radioactive atoms, but is equally applicable to the ordinary atoms. We have so far only discussed the possibility of neutral satellites in the form of α particles of mass 4. It is quite possible, however, that other types of neutral satellites may be present of mass 2 or 3. The possibility of the existence of such nuclei has been drawn attention to by several writers as types of secondary units which play a part in the building-up of nuclear structures, but they have usually been supposed to exist as charged rather than neutral masses. Such secondary neutral units may be able to exist only in the powerful nuclear fields and thus would never be observed in the free state.

This view of nuclear structure at once offers a reasonable explanation of the existence of a number of isotopes of an element of given atomic number. When once the central nucleus is formed, a number of neutral satellites can be added which are kept in equilibrium by attractive forces. Aston has shown in some cases that a large number of isotopes can exist, thus indicating that a number of satellites may be added without disturbing the equilibrium of the nuclear system. He has drawn attention to the remarkable fact that in all cases the odd-numbered heavier elements have either no isotopes differing in mass by two units, while even-numbered elements may have a whole group of isotopes. This striking distinction between the elements is paralleled by the observation that odd-numbered elements which are disintegrated by the bombardment of α particles emit protons at a much higher average speed than the even-numbered elements. Harkins has also shown that even-num-

bered elements are much more abundant in nature than the odd-numbered elements.

This difference in isotopic properties between even and odd elements seems very fundamental in character. A possible interpretation may be given on the general view of nuclear structure that we have outlined. It is supposed that the central nucleus is ordinarily made up of helium nuclei carrying two charges arranged in an ordered way, and for an even-numbered element there must be present an even number of electrons.

These would tend to arrange themselves in equilibrium so that the resultant magnetic moment of the system is a minimum. If now, by the addition of a proton or removal of an electron, an odd-numbered element is formed, there may be no longer possible that balance between the magnetic moments as in the case of an even-numbered element. The effect of the resultant magnetic field of the nuclear system may make it impossible for neutral satellites to circulate in permanently stable orbits round the nucleus. If this view be correct, we should anticipate that the nuclear magnetic moment of odd elements should differ markedly from that of even elements. As far as I am aware, there is at present no definite evidence bearing on this point.

In this discussion of atomic constitution, we have been referring for the most part to the heavier elements where the nucleus is considered to be composed mainly of α particles and satellites and where it is to be anticipated that the whole number rule of atomic mass should hold within small limits. If the presence of neutral satellites in the nuclear system depends mainly on the electric charge of the nucleus, the addition of such satellites may be possible only when the nuclear charge exceeds a certain value. For this reason, the constitution of the lighter elements may differ markedly in general features from the heavier elements and the departures from the whole number rule of atomic mass may be more emphasized than for the heavier elements. An accurate determination of the atomic mass of the lighter elements such as Dr. Aston is undertaking is thus of great theoretical, as well as practical, importance, as it may give us valuable information on the closeness of the binding of the component protons and electrons.

On account of the uncertainty of the constitution of the lighter elements, it is difficult to connect the disintegration of such elements by α particle bombardment with any special feature of their struc-

ture. The views given here are admittedly very speculative in character, but they may serve a useful purpose in suggesting possible lines of attack on this fundamental problem. Although the nucleus of a heavy atom is no doubt very complicated in structure, yet it may present certain simple general features which may be absent or difficult to detect in the lighter elements. For this reason, I am hopeful that we may yet be able by the study of radioactive data to throw light on some of the outstanding features of nuclear constitution of heavy elements.

CHAPTER REPORTS

CORNELL

The parent chapter is always active and enthusiastic. Meetings are held throughout the academic year, and culminate in the initiation exercises at the end of the year. Election was held May 2 and the initiation and banquet occurred May 18, with an attendance of 160. At the initiation ceremony, Professor Lewis Knudson, President of the chapter, delivered the address. At the dinner Professor R. A. Emerson presided and toasts were given by H. C. Harris, "The Initiates;" James Crack, "International Students;" and Dr. A. V. Hill. Dr. Hill emphasized the aim of Sigma Xi to increase friendliness among scientists and expressed the hope that this purpose would be developed and encouraged.

UNION

The chapter held three public meetings during the year and several business meetings. Papers were given by Dean Ellery on "Organized Research in Great Britain," and by Mr. L. A. Hawkins of the Research Laboratory of the General Electric Company on "The Engineer and Research." The final meeting was held jointly with the Rensselaer chapter and took the form of a complimentary dinner to the national officers. On this occasion the newly elected members were inducted into the society by Professor Moulton, National President.

YALE

Nine meetings were held by the chapter, three of which were public lectures attended by capacity audiences. Topics and lecturers were as follows:

"Research in Forestry." Provost Henry S. Graves.

"Explorations of 1925 in the Desert of Gobi." Prof. C. P. Berkey, of Columbia University (public lecture).

"The Boyce Thompson Institute for Plant Research and Its Work." Dr. William Crocker.

"Air Trotting in Europe, Asia and Africa." Major Lester D. Gardner (public lecture).

Annual Initiation and banquet. The Initiation address was delivered by Prof. Bradley Stoughton, of Lehigh University.

"The American Museum's Greenland Expedition of 1926." Mr. George Palmer Putnam (public lecture).

"The Obligations of Science." Dr. Charles H. Herty.

PENNSYLVANIA

During the year, four regular meetings and a joint meeting with the Phi Beta Kappa Society were held.

The first meeting was held in the Medical Clinic of the University Hospital. The following addresses illustrating the studies being carried on in the Department of Research Medicine and in the William Pepper Laboratory of Clinical Medicine were delivered:

"Serum Electrolytes and Their Changes in Disease." J. H. Austin.

"Recent Studies on the Physico-chemical Properties of Hemoglobin." W. C. Stadie.

"Modern Observations on the Value of Metabolism Studies." Leon Jonas.

"The Structure of the Coccidioidis Immitis." Florence E. Ahlfeldt.

"Work on the Focal Infection Theory." H. P. Schenck.

The laboratories were open for inspection both before and after the addresses. The meeting was preceded by a dinner at which 60 members and guests were present.

The second regular meeting was held under the auspices of the Wistar Institute of Anatomy and Biology. The following addresses illustrating studies being carried on there were delivered:

"The Museum of Casper Wistar." H. H. Donaldson.

"The Development of Behavior as Related to the Growth of the Nervous System." G. E. Coghill.

"The Development of Movement in the Albino Rat before Birth." (Motion pictures.) E. A. Swenson.

This meeting was preceded by a dinner at which 55 members and friends were present.

The third meeting was held in the Department of Pharmacology, in the Medical Laboratories of the University. The following addresses, illustrating the work of this Department, were delivered:

"How New Drugs Are Introduced into Therapeutics." C. F. Schmidt.

"Methods of Measuring Blood Flow through Living Tissues (Demonstration of Circulation of Blood in the Frog's Kidney)." A. E. Livingston.

"The Multiple Electrical Stethoscope (Demonstration of Heart Sounds)." C. J. Gamble.

At this meeting the initiation of new members took place. Forty were elected, twenty chapter members, and twenty associates. At the dinner preceding 97 were present.

The fourth regular meeting was held in the Museum of the University of Pennsylvania. The Curators and Docents met the members and guests and conducted them on a short tour of the Museum. The following addresses were then delivered by members of the Museum staff:

"The Year's Activities of the Museum." H. U. Hall.

"The Museum's Excavations at Ur of the Chaldees." (Illustrated.) L. Legrain.

About 80 members and guests attended the supper before the meeting, and about 150 heard the addresses.

The annual joint meeting with the Phi Beta Kappa Society was held June 8, 1927. Prof. R. H. True, Director of the Botanic Gardens and Professor of Botany at the University, spoke on "Incidents in the Life of a Prehistoric Farmer." An audience of 60 heard his delightful address.

The outstanding events of the year were the annual convention held here in December and the awards from the Chapter Research Fund.

STANFORD

During this, the twenty-sixth, year of the chapter's activities, three meetings were held in the interest of research, apart from the election and initiation of members:

Joint meeting with the Committee on Public Exercises. Professor J. H. Priestley, University of Leeds, England, delivered a lecture on "Light and the Growth of Plants."

Joint meeting with the Department of Chemistry. Professor A. Joffé, Director of the Institute of Pure Physics, Leningrad, delivered a lecture on "Cohesion of Crystals."

Joint meeting with the Science Association. Professor James M. Luck, Department of Chemistry, presented the results of research work on "The Intermediary Metabolism of Proteins."

On May 25, 1927, the chapter received the report of the Board of Electors, and on the evening of June 6, 1927, elected new members. The initiation address was delivered by President Le Roy Abrams. The latter part of the evening was given to refreshments and social intercourse.

CHICAGO

The chapter had a fine year. Lecturers and topics were as follows:

Dr. W. A. Taliaferro, "Some Aspects of the Malaria Problem To-day."

President Max Mason, "The Thermodynamic Universe."

Professor J. N. Broensted, "Modern Theory of Salt Solutions."

Dr. Carl A. Moore, "Some Problems in Sex Biology."

During the year 101 members and associates were elected and initiated.

MICHIGAN

At the meetings, lectures were given by Professor Paul S. Welch on "Biological Research Conditions in Europe," and by Dr. W. F. Gerhardt, Vice President and Research Director of the Aeronautical Research Corporation of Detroit, on "Aeronautics as a Means of World Transportation." These were open to the general public. At the annual initiation and dinner held at the Michigan Union, Professor E. M. Bragg, President of the chapter, delivered the address, taking as his subject, "Sigma Xi, Its Aims and Objects."

Other meetings were held as follows:

Public lecture by Professor Paul S. Welch. Subject, "Biological Research Conditions in Europe."

Public lecture by Dr. W. F. Gerhardt, Vice President and Research Director of the Aeronautical Research Corporation of Detroit. Subject, "Aeronautics as a Means of World Transportation."

MISSOURI

During the academic year the chapter had three business meetings, three private meetings for scientific discussion and social purposes and four public lectures.

The following lectures were given:

"Van't Hoff, His Life and Work," by Dr. Ernst Cohen, Director of the Chemical Laboratory, University of Utrecht.

"The Topography of the Moon," by Professor E. S. Haynes, University of Missouri.

"Numbers," by Professor G. E. Wahlin, University of Missouri.

"Some Protein Analogies of the Mycelium of *Fusarium Lycopersici*," by Dr. I. T. Scott, University of Missouri.

"Methods of Fundamental Research in Certain Virus Diseases," and "The Significance of Some Ultra-Microscopic Virus Studies in Relation to the Nature and Origin of Life," by Dr. B. M. Duggan, University of Wisconsin.

"The Larger Geological Conditions and Geographical Response in the Desert Region of the Southwest," by Professor E. B. Branson, University of Missouri.

"Measuring the Milky Way," by Dr. Harlow Shapley, Director of the Harvard College Observatory.

COLORADO

During the year papers were presented as follows:

"Anti-tubercular Immunity." Dr. R. C. Whitman.

"Teaching Biology in Schools." Dr. F. D. A. Cockerell.

"Geography and Human Affairs." Dr. Ralph H. Brown.

"Night in the Desert." Dr. Aven Nelson.

"Prehistoric Surgery in the Western Hemisphere." Dr. Lenard Freeman.

WORCESTER

Meetings, lecturers and topics, during the year, were as follows:

Dr. Maurice E. Smith spoke on the topic, "The First International Conference on Bituminous Coal."

Prof. Francis W. Roys, M.E., presented an illustrated lecture on "Recent Developments in Metallographic Research."

Initiation Meeting. Address by Capt. Ralph Earle, U. S. N., retired, on "The Gunnery Problem."

Annual Meeting. Election of Officers. Illustrated address by Jerome W. Howe, Professor of Civil Engineering, on "The Reservoir Systems of Worcester, Boston, and New York City."

PURDUE

Ten meetings were held during the year, and at nine of them lectures and discussions on a wide variety of topics constituted the program:

"Discoloration of Indiana Limestone." Prof. H. C. Pepper, Head of School of Chemical Engineering, Purdue University.

"Elements of Vector Analysis." Dr. Valadimir Karapetoff, Cornell University.

"Visions and Dreams of a Scientific Man." Dr. Paul R. Heyl, U. S. Bureau of Standards.

Joint meeting with Purdue Biological Society. "The Present Trend for Advancing Biological Research." Dr. L. R. Jones, University of Wisconsin.

"Use of Solutions for Standards of Color." Dr. M. G. Mellon, Chemistry Dept., Purdue University.

Joint meeting with Purdue Biological Society. "The Modern Status of Genetics." Dr. E. W. Lindstrom, Dept. Genetics, Iowa State College.

"The Atom as a Source of Energy." Dr. Arthur Haas, University of Vienna.

(a) "Objective and Human Physics." (b) "The Atom as a Source of Energy (cont'd)." Dr. Arthur Haas, University of Vienna.

Initiation meeting. "Opportunities in Research." Dr. G. I. Christie, Director of Purdue University Agricultural Experiment Station.

RUTGERS

During the college year the following meetings were held:

"The Plant Communities of the Medecian Bow Mountains in Wyoming." Dr. A. P. Kelly.

Special Business Meeting.

"Geological Formations Found in the Colorado Canyon and the Yellowstone Park." Prof. J. V. Lewis.

"Back to Aristotle." Prof. Wilder Bancroft.

McGILL

The chapter had eight meetings during the session, two of which took the form of smokers held in the Faculty Club of the University, one a luncheon held in the Botanical Laboratory and the remaining five were open to the public, being the occasions when distinguished guests gave illustrated lectures on various topics. The following are the subjects on which these visitors spoke at the public meetings of Sigma Xi:

"The Luminous Discharge in Rare Gases." Prof. R. Whiddington, F.R.S., of Leeds University.

"The Royal Botanic Gardens." Dr. A. W. Hill, F.R.S., Director of Kew.

"Modern Trends in the Study of Animal Development." Prof. R. G. Harrison, of Yale University.

"The Spiritual Life of the Esquimaux." Dr. Knud Rasmussen.

"Energy from the Sea." Monsieur George Claude.

All of these meetings were very well attended both by members of Sigma Xi and the public.

At the luncheon, which was held toward the end of February, seventeen full members and eight associate members were elected. The total active list of members in good standing during the year was ninety-five.

KENTUCKY

The year closed with the 6th annual banquet. The address on this occasion was given by Dr. H. L. Shautz, Professor of Botany, University of Illinois, on "Vegetation and Native Races of Eastern Africa." Six other meetings were held during the year, one of which was a public meeting, with an address by Dr. Oscar W. Riddell, of Cold Spring Harbor, on "The Newer Aspects of the Sex Problem." One of the six meetings was given by the Associates of the chapter and was the best attended of any of the gatherings.

VIRGINIA

The year was a very successful one. Five public lectures were given under the auspices of the chapter as follows:

"Meteors." Dr. Chas. P. Olivier, University of Virginia.

"The Economic Plants of the Bolivian Indians." Dr. Orland E. White, Brooklyn Botanic Garden.

"The Geology of the Headwaters of the Amazon." Dr. Joseph T. Singewald, Jr., Johns Hopkins.

"Achievements in Agricultural Research." Dr. T. K. Wolfe, Virginia Polytechnic Institute.

"Why Races Differ." Professor Ellsworth Huntington, Yale.

JOHNS HOPKINS

At the first meeting for the year an address was given by Dr. Leonor Michaelis, Resident Lecturer in Research Medicine, on

"The Significance of Physics and Chemistry for the Biological Sciences."

At other meetings papers were presented as follows:

"New Developments in the Treatment of Coal." Prof. A. G. Christie, Professor of Mechanical Engineering.

"The Cliff-Dwellers of Arizona and Their Predecessors." Dr. A. V. Kidder, Division of Anthropology and Psychology, National Research Council, Washington, D. C.

"Some Facts and Fancies of Weather Lore." Dr. W. J. Humphreys, U. S. Weather Bureau, Washington, D. C.

CALIFORNIA INSTITUTE OF TECHNOLOGY

Papers were given during the year as follows:

"Research at Aachen Technische Hochschule." Dr. von Kármán.

"Lightning Arresters and High Voltage Switch Problems." Prof. R. W. Sorenson.

"A New 50-Foot Interferometer." F. G. Pease.

"Life of van't Hoff." Prof. Ernst Cohen, Utrecht.

"Lightning Protection Problems." M. E. Dice.

"Infra-Red Solar Spectrums." Dr. H. D. Babcock.

"Hay Fever and Asthma." Dr. G. A. Alles.

"Tokyo Earthquake Conference." Prof. R. R. Martel.

"Recent Research at University of Leyden." Dr. H. A. Lorentz.

"Earth Tides." Dr. W. T. Whitney.

"The Companion of Castor." Dr. R. F. Sanford.

"Petroleum Researches." Prof. H. J. Lucas.

"Researches in Organic Chemistry." Dr. J. B. Conant.

"Researches on Acoustics." Dr. R. C. Burt.

"Excuses of a Scientist on Entering Politics." Dr. P. W. Merrill.

"Excuses of an Engineer on Entering Politics." Prof. R. L. Daugherty.

Reports on Developments Encountered during Trips to Eastern Meetings. Dr. J. A. Anderson, Dr. A. A. Noyes, and Dr. R. A. Millikan.

During 1926 and in the early part of 1927, under the auspices of the chapter, the following lectures on "Evolution" were given:

"Radiation and Spectroscopy." Dr. R. A. Millikan, Professor of Physics, California Institute.

"Structure of the Universe." Prof. F. H. Seares, Mt. Wilson Observatory.

"Nebulae." Dr. E. P. Hubble, Mt. Wilson Observatory.

"The Solar System." Dr. C. E. St. John, Mt. Wilson Observatory.

"Some Phases of the Evolution of Man." Dr. J. C. Merriam, President, Carnegie Institution of Washington.

"Geological History of the Earth." Dr. J. P. Buwalda, Professor of Geology, California Institute.

"Geological History of the Earth." Dr. J. P. Buwalda, Professor of Geology, California Institute.

"Evolution of Matter and Energy." Dr. R. C. Tolman, Professor of Physical Chemistry and Mathematical Physics, California Institute.

"Evolution of Stars." Dr. H. N. Russell, Professor of Astronomy, Princeton University.

"Evolution of Life on the Earth." Dr. Chester Stock, Professor of Paleontology, California Institute.

"Evolution of Life on the Earth." Dr. Chester Stock, Professor of Paleontology, California Institute.

"Glacial Evolution of the Alps." Dr. William Morris Davis, Professor of Geology, Emeritus, Harvard University.

"The Development of Land Vegetation in Relation to Earth History." Dr. Ralph W. Chaney, Research Associate, Carnegie Institution of Washington.

"Evolution of Bird Life." Dr. Loye H. Miller, Professor of Biology, University of California at Los Angeles.

NEW YORK UNIVERSITY

The first meeting of the academic year 1926-1927 was a lecture by Mr. George A. Orrak, Consulting Engineer of the New York Edison Co. The subject of Mr. Orrak's address was "The Trend of Electric Power."

The second public lecture, "Cambridge and the English University System" was delivered by Professor George H. F. Nuttall, Professor of Biology and Director of the Molteno Institute for Research in Parasitology, University of Cambridge, Cambridge, England.

The next meeting consisted of a demonstration meeting at which the Department of Physics of New York University entertained the chapter. Demonstrations of researches in progress were made. Refreshments were served.

Following this meeting the Biology Department entertained the chapter. There were four fifteen-minute papers describing investigations under way and twenty-two demonstrations presenting the results of studies nearing completion. Refreshments were served at this meeting.

The last open meeting of the year was a lecture given at the New York University and Bellevue Medical School. An address on "The Earliest Races of Man" was given by James H. McGregor, Professor of Zoölogy, Columbia University, New York.

CLUBS

UNIVERSITY OF OKLAHOMA

The Club has just closed another successful year. At the six regular meetings the following papers were given:

"Correlation of Formations by Microscopic Fossils." Dr. C. E. Decker.

"The Effect of Position of Groups in the Benzene Ring on the Formation of Phenyl-Ethers." Dr. J. C. Colbert.

"The Photo-Electric Effect and the Nature of Light." Dr. J. R. Nielsen.

"The Adsorption of Gases by Metal Films." Dr. L. E. Swearingen.

"Gravity Measurements and Isostasy." Dr. F. A. Melton.

"The Effect of Illumination and Temperature on the Elongation of Root Hairs." Dr. R. E. Jeffs.

FELLOWSHIP LETTERS

"The circular letter to members of the Sigma Xi reached me a day or two ago. I value my membership in this Society and considered it a very considerable compliment when I was elected to membership. It was organized at Cornell two years after I graduated, but the members of the Class of 1886 who were instrumental in organizing this Society were personal friends of mine and I have known of the progress of this Society from its very birth under a cherry tree in the back yard of Mrs. Gillette, on Factory Street in Ithaca, on a hot summer Sunday afternoon at the end of the college year. My connection with the Society has been rather tenuous, but to judge by the valuable contributions which its members are making to science and its devotees there is a very considerable amount of work being done by the society in various fields of endeavor.

"I take pleasure in enclosing \$3.00 as you request. I would like to receive the Sigma Xi QUARTERLY publication with which I am entirely unfamiliar. Moreover, if this periodical has been published for any length of time, I would greatly like to have a complete file furnished me from the beginning. I will have it bound volume by volume and place it in the Library of the Cornell Club of this City of which I have the honor to be Librarian."

"I wonder why there is not a chapter of Sigma Xi at Harvard University.

"Since Tau Beta Pi has recently entered the hallowed shades of Cambridge, I should like to see the scientific brotherhood also established there.

You see, I got my E.M. at Columbia, but my A.B. at Harvard."

"I shall be very glad to subscribe regularly toward the research projects in which Sigma Xi is interested. I am very much interested in research work myself, and, so far as my health permits, I give my spare time to chemical research, and am therefore naturally interested in the general question of scientific research.

"I shall be very glad to have any information you can give me as to what organizations the alumni members are forming.

"The list of fellowships that have been awarded for 1926-27 interests me very much, particularly that awarded to Prof. Rutherford, who

has given so much time and thought to his work and whose books I have found of intense interest."

"Your recent general letter, of which I have received a copy, was received with welcome by me partly because of the information regarding Sigma Xi therein contained and more so as it is the first communication from the Society I have received in a number of years. In fact, the 'little contact,' referred to in your letter, is truly correct.

"In response to your invitation to contribute to the research fund I am enclosing herewith my check for the amount of \$3.00. I desire and will be pleased to receive the Sigma Xi *QUARTERLY*.

"I am retaining your letter as a matter of personal interest. Please be assured that I shall welcome any information regarding the activities of the Society."

"I have much pleasure in responding to your invitation of last month to contribute my mite to the research fund of Sigma Xi. I am proud of being a member of this Honour Society and shall be glad to be kept in touch with its organization. I enclose, therefore, a money order for 12 shillings and 6 pence which, if the exchange does not meanwhile markedly alter, should yield you rather over \$3.00.

"I recall with pleasure the occasion on which I met you here towards the end of 1925. I trust that your stay on this side was one which will be full of pleasant memories to you."

(University of Aberdeen, Scotland.)

"I have received your letter asking for a contribution of \$3.00 per year to be paid into the Sigma Xi treasury.

"I do not intend to pay this amount, chiefly because it seems to me that the Society is not doing its utmost to promote research. For a number of years the ————— has made it quite clear to the executive committee of Sigma Xi that it is willing to establish a chapter here and as yet nothing has been done about it. I am certain that this school is at least as well qualified for membership as many of the schools that are already listed as such, and until we have a chapter here I have no intention of paying anything into the parent Society.

"I have not consulted any of the other members of Sigma Xi that are on the faculty here concerning the matter and my reply is entirely independent of them."

"Your communication regarding Sigma Xi is at hand. I am to be engaged in further graduate work this coming year and have to make every dollar count: consequently cannot help, even with the small amount requested, at this time. If you will remind me the next year, I think I shall not only be glad, but able, to help a little."

"I am in receipt of your letter telling of the activities of the Society in connection with its research promotion activities. I have found the letter quite interesting. I am enclosing a check for three dollars (\$3.00) and have filled out the blank spaces as per your suggestion.

"Since graduating from college (Purdue University) it is true I have lost contact to a large degree with Sigma Xi and I feel that I have lost considerably thereby. I am glad to accept the opportunity to again contact with it and become more acquainted with its activities.

"In the rush of events directly after my graduation in 1919 I did not possess myself with an insignia of Sigma Xi. Since that time I have put it off from time to time with no definite thought about it, all no doubt because of this loss of contact. Could you please furnish me with information relative to the purchase of an insignia?"

"I am enclosing the \$3.00 requested, chiefly because I do not approve of the uses to which the Society intends to put it.

"Perhaps I take the expressed ideals of the Society too seriously or am inclined to interpret them too literally. It seems to me that, if the Society has or can raise funds for the promotion of research, they should be employed to further the general interest of research and of research workers and not for financing individual enterprises. For instance, they could hardly serve a better purpose than to finance a genuinely scientific determination and development of methods for making scientific researches self-supporting. I do not consider that an unattainable goal, for the philosophy of Can't is discredited. Surely, Sigma Xi should aspire to something nobler than the perpetuation of the false belief that research workers, in general, must inevitably be objects of charity.

"Moreover, I cannot see why any self-respecting scientist, much less some of the eminent ones listed with your letter, can accept from the Society funds that they know are begged from the scanty gleanings of their fellows. Nobody realizes better than I how diffi-

cult it is to finance many abstract researches. But every research worker should expect hard work and should learn first sound methods of accomplishing the difficult part of his work, namely, the financing. He should have a well developed sense of perspective and not be encouraged in narrowness."

"Your letter concerning the Sigma Xi Fellowship Fund, also the list of persons who have been given grants, both have been received. I am glad to see that these men can be assisted in this way. It is a most discouraging situation that most of us face, regarding research, constantly paying out money from our mediocre salaries to carry on our personal research, with little or no encouragement. Please find enclosed my cheque for two dollars for my fourth payment."

"I was very much pleased to receive your circular letter of April 27 addressed to the alumni members of Sigma Xi. It is not only a pleasure to get this information concerning the activities of our honorary Society, but to indirectly have a word from you.

"In compliance with your suggestion, I am pleased to enclose a check for \$3.00 and shall be glad to receive the QUARTERLY."

IN MEMORIAM

Professor G. D. Shepardson, Head of the Electrical Engineering Department, University of Minnesota.

Dr. Edwin B. Payson, Professor of Botany, University of Wyoming.

Dr. Mabel Mary Brown, Professor of Botany, University of New Hampshire.

Dr. Holmes Condict Jackson, Dean of the Dental School, New York University.

CHAPTER OFFICERS

LIST FURNISHED BY THE CORRESPONDING SECRETARIES OF THE CHAPTER

| CHAPTER | PRESIDENT | VICE-PRES. | SECRETARY | TREASURER |
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| Union..... | P. I. Wold.... | J. W. Mavor... | C. B. Hurd... | C. B. Hurd |
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| Yale..... | Leigh Page... | Adolph Knopf.. | A. F. Hill..... | L. E. Seeley |
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| Nebraska..... | E. F. Schramm | M. H. Swenk... | E. N. Andersen | M. G. Gaba |
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| Stanford..... | J. E. Coover... | C. L. Alsberg... | G. M. Smith... | D. L. Webster |
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| Syracuse..... | C. L. Brightman | C. C. Carpenter | P. J. Sedgwick.. | C. C. Forsaith |
| Wisconsin.... | E. M. Terry... | | E. L. Sevringhaus | H. A. Schuette |
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| Virginia..... | W. A. Nelson.. | L. G. Hoxton.. | B. D. Reynolds. | B. D. Reynolds |
| Johns Hopkins | B. E. Livingston | K. Dunlap.... | M. W. Pullen... | R. P. Cowles |
| Calif. Institute of Technology | R. C. Tolman.. | J. A. Anderson. | W. H. Clapp... | S. S. Mackeown |
| New York University... | H. D. Senior... | R. Mulliken... | H. W. Stunkard | H. W. Stunkard |
| University of Cincinnati... | H. S. Fry..... | O. T. Wilson... | S. B. Arenson.. | S. B. Arenson |
| Michigan State College | G. W. Bissell.. | G. H. Coons... | R. M. Snyder.. | J. W. Crist |

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| University of Florida..... | G. F. Weber... | T. R. Leigh.... | F. J. Bacon.... | F. J. Bacon |
| University of Rochester... | J. R. Murlin... | | H. L. Alling.... | H. L. Alling |
| Colorado Agri- cultural Col- lege..... | G. T. Avery... | L. D. Crain.... | L. W. Durrell.. | L. W. Durrell |
| State College of Washington | C. C. Todd.... | | Hannah Aase | |

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OFFICIAL ANNOUNCEMENTS

All insignia of the Society are available only through the office of the national secretary. Orders for these insignia are issued through chapter secretaries, and must be **prepaid**. Information about styles and prices may be obtained from chapter secretaries or the national secretary.

PRINTED BLANKS

The General Convention has instructed the secretary to forward to chapters under the following stipulations:

Membership Certificates, stamped with the great seal of the Society. In packages of fifty prepaid, on advance payment of \$2.50 for each package. Please specify carefully whether for active or associate members.

Index Cards, for enrolled Members and Associates for the records of the Society maintained in the secretary's office. Sent on request.

Chapter secretaries are requested to fill out these cards carefully giving **PERMANENT** addresses of the members, and return to the national secretary.

A few copies of the Quarter Century Record are available at \$2.50 each.

Copies of the Constitution are available at 7 cents each.

SIGMA XI BANNERS

Chapters may obtain Sigma Xi Banners at the following prices:

Size 3 x 5—\$ 8.00

4 x 6— 12.00

5 x 8— 20.00

CHANGES OF ADDRESS

Changes of address of Members and Associates not enrolled in chapters and all other correspondence should be addressed to the secretary of Sigma Xi, Edward Ellery, Union College, Schenectady, N. Y.

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